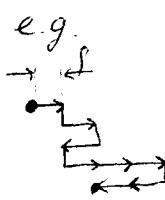


they ask for the limit  $\epsilon \gg \tau$  they want the answer to be expressed as a Taylor series in  $X$ , where  $X = \frac{\epsilon}{\tau} \ll 1$  with only the first non-zero term kept (not the first term, which could be zero, but the first non-zero term!). In our case, however, attempting to implement that literally would generate a Taylor series with all terms equal to zero. In that case you need to choose another variable, related to  $X$ , that's also small, and try expanding in terms of this other variable. The variable I chose,  $e^{-\epsilon/\tau}$ , seems the most appropriate. The main point is that they don't want an answer that's exactly 0, unless it is, indeed, zero for large enough  $\frac{\epsilon}{\tau}$ . In our case the answer is zero if  $\frac{\epsilon}{\tau}$  is 0, but is non-zero if  $\frac{\epsilon}{\tau}$  is large but finite.

3). With enough practice, you can evaluate the first non-zero term in the Taylor series rather quickly. The main idea is to ignore all terms with higher powers of  $X$ . For example,  $1-X \approx 1$ ,  $1-X^{N+1} \approx 1$ ,  $0+X+2X^2+\dots \approx X$ . Hence,  $\langle A \rangle \approx X$ . Fast and easy!

## (2) 3.10 in Kittel - Elasticity of polymers.



e.g.  
 $N_r = 5$ ,  $N_e = 3$ ,  $s = 1$ ,  $\ell = 2p$

(a) Define  $N_r$  ( $N_e$ ) - the number of links directed to the right (left)

Define the excess  $s = \frac{N_r - N_e}{2}$ . By analogy with the coin problem, treated in Ch.1, we get:

$$(eq. 15) \quad g(N, s) = \frac{N!}{(\frac{1}{2}N+s)! (\frac{1}{2}N-s)!} .$$

Note that  $g(N, -s) = g(N, s)$ . Now, it's clear that opposite excesses will produce the same length, since length  $\propto |N_r - N_e|$ . More precisely,

$$\ell = p |N_r - N_e| = p 2 |s|$$

Therefore the total number of states producing a given length  $\ell$  is equal to